Predicting Responses of Chemical and Biological Water Quality to Human-induced Environmental Changes: The Case Study of Clariano River, Spain

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Abstract

Freshwater ecosystems provide many benefits to a variety of species but, unfortunately, human-caused environmental issues are undermining their ability to provide key functions and services. Changes in climate and land use, for instance, impact the habitat suitability for freshwater organisms by affecting water quantity and quality. Nutrients, pesticides, heavy metals and other contaminants which are released to the environment as a result of anthropogenic activities have the potential to degrade the environment and damage freshwater communities. Hence, the present research activity aims to investigate aquatic ecosystem responses to environmental deterioration using a case study of Clariano River, Spain. The Soil and Water Assessment Tool (SWAT) is used as an eco-hydrological tool to model discharge, sediment and nutrients, and to predict the biological status in Clariano River under different scenarios. As the diversity and presence of species represent the quality of ecosystem, this study focuses on macroinvertebrates as biological indicators of stream health. The SUFI-2 algorithm in the SWAT-CUP program is used for the calibration, validation, sensitivity and uncertainty analysis of the SWAT model. The results from the calibrated model are then coupled to regression equations between measured nutrient concentrations and values of several macrobenthic metrics in six sampling sites along the Clariano River. The coupling of these regression equations with concentrations simulated with SWAT for different scenarios allows to improve the understanding of the relations between environmental changes in watersheds, nutrient concentrations, and the biologic status of stream water.

Keywords: water quality, macroinvertebrates, environmental degradation, eco-hydrological modelling, Clariano River